

Change in the impact of Turkish Orthopedics and Traumatology on international scientific literature

Türk Ortopedi ve Travmatolojisinin uluslararası bilimsel literatüre olan etkisindeki değişim

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ABSTRACT

The aim of our study is to investigate change in the impact of Turkish Orthopedics and Traumatology on the international scientific literature by examining the success of the *Acta Orthopaedica et Traumatologica Turcica* (AOTT) journal. All clinical research articles published in the AOTT between 2006 and 2015 were included in the study. The number of citations and the factors (number of centers participating in the study, the origin of study (domestic-foreign), design, level of evidence, type and subtype of studies) that may affect the number of citations were evaluated. A total of 517 clinical research articles were evaluated. There has been an increase in the citation rate over the last five years ($p=0.046$). The majority of the articles were multi-center (54.9%) and domestic-origin (85.1%). In the last five years, there has been an increase foreign-origin articles ($p=0.01$). The majority of the articles was level 4 (76.2%) and designed retrospectively (95.9%). In the last five years, there has been an increase in the evidence levels of the articles and prospectively design studies ($p=0.07$, $p=0.157$, respectively). The majority of the articles were related to treatment of the diseases (74%). In the last five years, there has been an increase in the studies related to economic and decision analysis ($p=0.055$). Articles were mostly related to trauma (26.5%). In the last five years, there has been an increase in the number of articles related to arthroplasty, and a decrease in those associated with foot-ankle and pediatric orthopedics ($p=0.022$, $p=0.036$, $p=0.007$, respectively). As a result; it was seen that Turkish Orthopedics and Traumatology increased its influence on the international scientific literature between the years 2011-2015.

Keywords: Turkish orthopedics and traumatology, literature, impact

Öz

Çalışmamızın amacı, Türk ortopedi ve travmatolojisinin uluslararası bilimsel literatüre olan etkisindeki değişimi *Acta Orthopaedica et Traumatologica Turcica* (AOTT) dergisinin başarısını inceleyerek araştırmaktır. 2006-2015 yılları arasında AOTT'de yayımlanmış tüm klinik araştırma makaleleri çalışmaya dahil edildi. Atıf sayısı ve atıf sayısını etkileyebilecek faktörler (çalışmaya katılan merkezlerin sayısı, çalışmanın orijini (yurt içi-yurt dışı), dizaynı, kanıt seviyesi, çalışmaların tipi ve alt tipi) değerlendirildi. 517 klinik araştırma makalesi değerlendirildi. Atıf alma hızında son beş yılda artış görüldü ($p=0,046$). Makalelerin çoğunluğu çok merkezli (%54,9) ve yurt içi orjinli (%85,1) idi. Son beş yılda yurt dışı orjinli makale sayısında artış görüldü. Makalelerin çoğunluğu Level 4 (%76,2) ve retrospektif dizaynlydı (%95,9). Son beş yılda makalelerin kanıt seviyelerinde ve prospektif dizaynly çalışma sayısında artış görüldü (sırasıyla; $p=0,07$; $p=0,157$). Makalelerin çoğunluğu terapötik tipteydi (%74). Son beş yılda ekonomik ve karar analizi çalışma tipinde artış görüldü ($p=0,055$). Makaleler, en sık travma ile ilişkiliydi (%26,5). Son beş yılda artroplastik ile ilişkili makale oranındaki artış, ayak-ayak bileği ve pediatrik ortopedi ile ilişkili makale oranında azalma görüldü (sırasıyla; $p=0,022$; $p=0,036$; $p=0,007$). Sonuç olarak, Türk ortopedi ve travmatolojisinin 2011-2015 yılları arasında uluslararası bilimsel literatür üzerindeki etkisini artırdığı görüldü.

Anahtar kelimeler: Türk ortopedi ve travmatolojisi, literatür, etki

INTRODUCTION

One of the indicators of the level of scientific deve-

lopment of a country is the impact on the relevant field of journals published in that country. The number of citations is an important indicator used to eva-

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uate the impact of a journal's articles on the relevant field¹. The number of citations and the parameters associated with them are often used to evaluate the success of scientific journals. The number of citations can be affected by many factors^{2,3}.

Turkish Orthopedics and Traumatology successfully represents our country in the international arena by publishing scientific articles with higher impact factors. *Acta Orthopaedica et Traumatologica Turcica* (AOTT) is one of leading medical journals in the field of Orthopedics and Traumatology in Turkey, which has been indexed⁴ in Science Citation Index-Expanded (SCI-E) since 2008. Although there are very few studies in the literature evaluating the scientific success of AOTT⁵, there has been no study examining the number of citations used as success criteria and the factors that could affect the number of citations.

The aim of our study is to investigate the impact of the Turkish Orthopedics and Traumatology on the international scientific literature by examining the number of citations to the clinical research articles published in the AOTT between 2006 and 2015 and the characteristics of the factors (number of centers participating in the study, the origin of study (domestic or foreign), design, level of evidence, type and subtype of studies) that may affect the number of citations.

MATERIALS and METHODS

All articles published in the AOTT from January 2006 to December 2015 were evaluated. Clinical research articles were included in the study. The experimental, biomechanical, cadaveric studies, case reports, letters to the editor, technical notes, questionnaire surveys, basic research studies and supplementum numbers were excluded.

In determining the number of center from which the articles were sent, the institutions where the authors worked were taken into account. According to this, the articles whose authors working in the same institution were accepted as single-center whereas those

involve many authors working in different institutions were accepted as multi-center studies.

In determining the origin of articles, the country of the first author was taken into consideration. According to this, the articles were examined in two groups as domestic and foreign-origin. Domestic articles were examined according to the geographic regions of Turkey where they came from in seven groups as follows: Marmara, Aegean, Mediterranean, Black Sea, Central Anatolia, Eastern Anatolia and Southeastern Anatolia.

The number of citations to the articles (number of citations given in Google academic till 05.12.2016), the rate of citation (number of citations/time), study design of the articles, the changes in study types and subtypes were evaluated in two different periods covering 2006-2010 and 2011-2015.

The articles were examined in two groups as prospective and retrospective in terms of the time periods (past, future) they studied, and in five groups from 1 (highest evidence level) to 5 (lowest evidence level) in terms of their levels of evidence⁶. The articles were examined in four groups in terms of their fields of study as therapeutic, diagnostic, prognostic and economic and decision analysis^{6,7}.

The articles were examined in nine groups according to their region of interest as arthroplasty, foot-ankle, sports injuries, spine, tumor, pediatric orthopedics, trauma, hand and upper extremity and others. Articles related to hip fracture patients who underwent arthroplasty were included in the arthroplasty group if no comparison was made with a patient group who underwent internal fixation in the same study. The articles related to spine trauma were included in the spine group, and in the pediatric orthopedics if it is related to pediatric trauma. The hand and upper extremity group included articles related to hand trauma (traumas in the distal part of the radius and ulna), and the tumor group contained articles related to pathological fractures developing on the tumor base, and all other traumas except these were inclu-

ded in the trauma group. While articles related to the shoulder and elbow arthroscopy out of arthroscopic interventions at the upper extremity were included in sports surgery, the ones related to wrist arthroscopy were included in the hand and upper extremity group. Articles that couldn't be included in any group were categorized in the miscellaneous group.

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. Mann-Whitney U test was used in the comparisons of two groups of quantitative variables with non-normal distribution. Pearson chi-square test, Fisher's exact chi-square test and Yates' Continuity Correction were used for comparisons of qualitative data. The significance was assessed at $p < 0.01$ and $p < 0.05$ levels.

RESULTS

Between 2006 and 2015, 517 clinical research articles have been published in AOTT. The majority of the articles were multi-center (54.9%) and domestic-origin (85.1%). Most of the national articles were from Marmara Region (53.2%) and the least were from Eastern Anatolia Region (1.1%). The detailed distribution of the characteristics regarding the years of publication, the number of centers participated in the study and whether the articles were domestic or foreign-origin have been shown in Table 1.

The average number of citations to the articles was 14.7 in the first five years and 5.6 in the last five years. It was seen that there had been a significant increase in citation rate within the last five years (2.98 ± 7.23) compared to the first five years (2.04 ± 3.38) ($p < 0.05$). Table 2 shows the detailed distribution of the characteristics related to the number of citations to the articles and the rate of citation by years.

While the publication rate of domestic articles was distinctly high in both periods (90.8% and 80.3%, respectively), it was seen that there had been a significant increase in the publication rate of foreign articles (19.7%) in the last five years ($p < 0.05$). In terms of

Table 1. Characteristics of the articles in relation to publishing years, publication locations and centers between 2006-2015.

	n	%
Year		
2006	43	8.3
2007	41	7.9
2008	44	8.5
2009	57	11.0
2010	53	10.3
2011	47	9.1
2012	49	9.5
2013	37	7.2
2014	74	14.3
2015	72	13.9
Central		
Single-centered	233	45.1
Multi-centered	284	54.9
Place of publication		
Other countries	77	14.9
National	440	85.1
- Marmara region	234	53.2
- Aegean region	68	15.5
- Mediterranean region	13	3.0
- Black Sea region	16	3.6
- Central Anatolia region	94	21.4
- Eastern Anatolia region	5	1.1
- Southeastern Anatolia region	10	2.3

Table 2. Characteristics of the articles based on citation number and rate between 2006-2010 and 2011-2015.

	Year		P
	2006-2010 (n=238)	2011-2015 (n=279)	
Number of citations	3506	1586	
The time between the publication of the article and the time the data was collected (year) (Mean±SD)	7.84±1.41	2.73±1.44	
Citation rate (Mean±SD)	2.04±3.38	2.98±7.23	^a $p < 0.05^*$

^aMann Whitney U Test

the level of evidence, while the rate of level 4 articles was distinctly high in both periods (76.5% and 76.0%, respectively), it was seen that there had been an increase in the articles' level of evidences in the last five years, but without any level of statistical significance ($p = 0.073$). In terms of study design, although the citation rate of retrospectively designed articles was high

in both periods (97.5% and 94.6%, respectively), an increase in the rate of prospectively designed articles (5.4%) was observed in the last five years, but without any level of statistical significance ($p=0.157$). Although increased number of articles appeared in the AOTT concerning the field of therapeutics in both periods (72.7% and 75.3%, respectively), an increase in the rate of economic and decision analysis type (12.2%) was observed in the last five-year period, but without any level of statistical significance ($p=0.055$) (Figure 1). Regarding the study subtype, although the citation rates of articles related to trauma were high in both periods (25.6%, 27.2% respectively), the increase in the number of articles related to arthroplasty (17.6%) ($p<0.05$, and the decrease in the rate of article related to foot-ankle and pediatric orthopedics (4.3%, 6.1%, respectively) were at the significant level ($p<0.05$) in the last 5 years (Figure 2). The detailed distribution of the characteristics of the articles by years has been shown in Table 3.

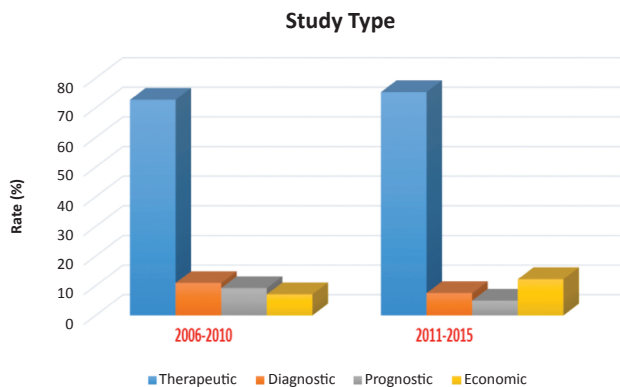


Figure 1. Distribution of article types by years.

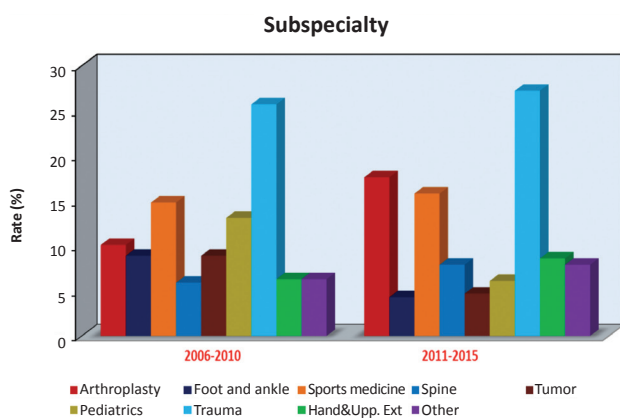


Figure 2. Distribution of article subtypes by years.

Table 3. Distribution of the characteristics of articles according to years.

		Year		P
		2006-2010 n=238 (%)	2011-2015 n=279 (%)	
Origin	Domestic	22 (9.2)	55 (19.7)	^a $p<0.01^{**}$
	Foreign	216 (90.8)	224 (80.3)	
Level of Evidence	Level 1	2 (0.8)	5 (1.8)	^b 0.073
	Level 2	4 (1.7)	15 (5.4)	
	Level 3	50 (21.0)	47 (16.8)	
	Level 4	182 (76.5)	212 (76.0)	
Study Type	Therapeutic	173 (72.7)	210 (75.3)	0.505
	Diagnostic	26 (10.9)	21 (7.5)	
	Prognostic	22 (9.2)	14 (5.0)	
	Economic and decision analysis	17 (7.1)	34 (12.2)	
Study design	Prospective	6 (2.5)	15 (5.4)	^c 0.157
	Retrospective	232 (97.5)	264 (94.6)	
Subspecialty	Arthroplasty	25 (10.5)	49 (17.6)	^a $p<0.05^{*}$
	Foot and ankle	21 (8.8)	12 (4.3)	^a $p<0.05^{*}$
	Sports medicine	35 (14.7)	44 (15.8)	^a 0.737
	Spine	14 (5.9)	22 (7.9)	^c 0.472
	Tumor	21 (8.8)	13 (4.7)	^c 0.084
	Pediatrics	31 (13.0)	17 (6.1)	^a $p<0.01^{**}$
	Trauma	61 (25.6)	76 (27.2)	^a 0.679
	Hand&Upp. Ext	15 (6.3)	24 (8.6)	^c 0.412
	Other	15 (6.3)	22 (7.9)	^a 0.487

^aPearson chi-squared test, ^bFisher's exact chi-square test, ^cYates' Continuity Correction, ^{*} $p<0.01$, ^{**} $p<0.05$

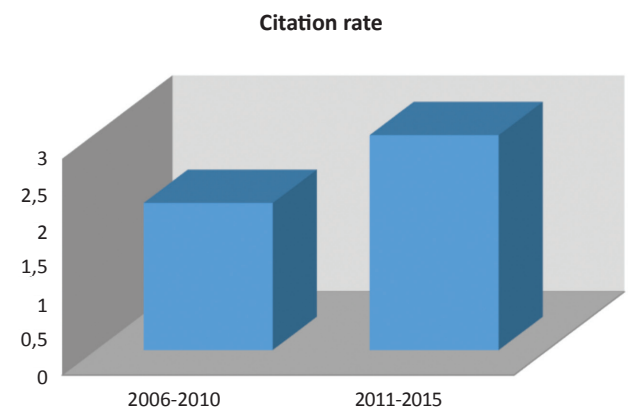


Figure 3. The distribution of the characteristics of the articles by their citation rate over the years.

DISCUSSION

Acta Orthopaedica et Traumatologica Turcica is one of leading journals in the field of Orthopedics and

Traumatology in Turkey since its first publication in 1962 and it has gradually increased its success to international level since it started to be indexed in SCI-E in 2008⁴.

In the evaluation of the performance of scientific journals, changes over the course of 10 years are often used⁸. In our study was investigated the impacts of the Turkish Orthopedics and Traumatology on the international scientific literature by examining the number of citations to the clinical research articles published in the AOTT between 2006 and 2015 and the characteristics of the factors that may affect the number of citations. As a result of our study, it was seen that Turkish Orthopedics and Traumatology increased the impact on international scientific literature in parallel with the success of AOTT over the years.

In our study, the changes in the scientific achievement of AOTT was assessed by examining the number of citations to clinical research articles published in this journal between 2006 and 2015 and the factors that may affect the number of citations. This study has demonstrated that the citation rate of AOTT in last five years was high at a significant level, and the scientific quality level of the journal have increased over the years.

Increasing the sample size in scientific articles makes it possible to reach the information that can be more generalized about the results of the study. One of the ways to increase the sample size is to increase the number of centers participating in the study. Since multi-center clinical studies provide sufficient number of different participants in much shorter time, they are more effective than single-center studies⁹. The majority of the articles in AOTT were multi-center in which we set the number of centers according to the number of institutions of the authors. We observed, however, that the majority of these studies were conducted from a single-center, even if their authors worked in different institutions, and therefore did not actually increase the number of samples. We believe that the AOTT may become a

journal that would have more frequently cited articles with higher scientific quality coming from larger scale multi-center studies.

The idea of the simplification of information transfer and sharing information around the world have increased the accessibility and recognition of journals⁷. Huh et al.³ noted that the participation of authors from various countries and the publication of the journal in English would increase its circulation and number of citations. AOTT has been published both in Turkish and English since 2010⁵. In our study, although the citation rate of articles of domestic-origin was distinctly high in both periods, the significant increase in foreign-origin articles in the last five years, indicates that the AOTT's accessibility and recognition have increased. We believe that the accessibility and the increased recognition of the AOTT will allow it to choose higher quality articles among many at the time of publication, which in the course of years will contribute to the journal's higher scientific quality with more cited articles.

Orthopedic surgeons are always interested in evidences and want to use them to make decisions depending on patients' needs and conditions⁶. Articles in journals of high scientific quality are good sources for orthopedic surgeons, providing them the evidence they need. It has been reported in the literature that articles having higher level of evidence have been more cited¹⁰. Even if the articles having higher level of evidence are more convincing in resolving clinical dilemmas, this can not always be achieved¹¹. It has been reported that level 3 and 4 studies still hold the majority in the orthopedics and traumatology literature⁶. However, Reich MS et al.⁷ indicated that globally, Level 1, Level 2 and Level 3 studies are gradually being published more, while Level 4 studies are being published less and less. Similarly, Scheschuk JP et al.¹² have shown that the number of low evidence-level studies in the orthopedic traumatology literature decreased in a significant level. In our study, the citation rates of level 4 articles were high in both periods in terms of level of evidence. Regarding the study design, the citation rates of retrospectively

designed articles were distinctly high. We think that level 4 and retrospective studies are more frequently preferred because they are easy to perform with lower cost. In our study, although there was no significant difference, the increase in the level of evidence of the articles over the last five years and increase in the number of prospective studies were consistent with the literature^{7,12}, which is promising in terms of increasing the scientific quality of the journal.

The classification of studies in a journal so as to clearly articulate the primary research topic facilitates the orientation of the reader to the area of interest. Easy access to an article about the subject that the reader is searching for, can lead to the beginning of the process that would increase the interest towards that journal and trigger the increase in its recognition, and ultimately the number of citations and scientific quality of the articles. Reich MS et al.⁷, evaluated the articles published in the Journal of Bone and Joint Surgery (JBJS) between 1980 and 2010, and showed that 71.9% of the articles were based on therapeutic studies, while the number of studies related to the treatment, and prognosis has increased in Asian and European-origin articles, while and in North American-origin journals the number of economic and decision analysis type studies have increased over the years. In our study, regarding the study types, although the citation rate of therapeutic type articles was distinctly high in both periods, we observed an increase in the number of publication rate of economic and decision analysis studies in the last five-year period even though this was not at the significant level (Figure 1). The types of articles published in AOTT were similar to JBJS, which is a highly recognized journal in orthopedics and traumatology because of the high number of citations to its articles and high level of scientific quality.

The number of citations is related to the study subtypes published in a journal. Holzer LA et al.¹³ indicated that the articles published in JBJS were mostly in hip category, followed by knee and trauma, and the least frequently published articles were in the hand and wrist category. They also reported that the high-

est citation of all categories was made to the hip category. In our study, the most frequently published articles in AOTT were trauma related and the least frequently published articles were related to foot and ankle. Regarding the years, although the citation rates of articles related to trauma were high in both periods, an increase was observed in the number of articles related to arthroplasty, and the decrease in the number of articles related to foot-ankle and pediatric orthopedics over the last five years (Figure 2). Trauma is the most common diagnosis in orthopedic surgeons' daily practice, and detection of higher number of articles related to trauma is not surprising. The indications of arthroplasty has increased in parallel to technologic improvements with better implant design, and it might be expected that the number of publications related with arthroplasty will increase over the years. Whereas the decline of the number of articles related to foot-ankle and pediatric orthopedics over the years might be due to the fact that there has been a decrease in diseases related to pediatric orthopedics such as pes equinovarus deformity, developmental hip dysplasia, polio, and early diagnosis and conservative methods have come to the front, and hence there are small number of orthopedic surgeons working on these diseases.

The limitation of our study is that we have only evaluated clinical research articles. Not including all publications in the AOTT may underestimate the number of citations. However, the majority of publications in the AOTT are clinical research articles. We believe that the examination of clinical research articles will be sufficient to generalize the scientific level of the journal. However, new studies involving all studies published in AOTT can provide more accurate data regarding the scientific level of the journal.

As a result; this study has demonstrated that the majority of the articles published in AOTT are related to multi-center, domestic-origin, retrospective, therapeutic type and trauma-related studies having the evidence level of 4. However, over the years; prospective studies of foreign-origin, economic and decision-analysis type, having high level of evidence

and and arthroplasty related articles have been more frequently published in AOTT. Consequently the popularity of AOTT has gradually increased with articles having high citation rate, and high scientific quality. This success of the AOTT was significant in that it has demonstrated that Turkish Orthopedics and Traumatology increased the impact on international scientific literature.

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REFERENCES

1. Baldwin K, Namdari S, Donegan D, Kovatch K, Ahn J, Mehta S. 100 most cited articles in fracture surgery. *Am J Orthop* (Belle Mead NJ). 2013 Dec;42(12):547-52.
2. Glänzel W. Bibliometrics as a research field: A course on theory and application of bibliometric indicators. COURSE HANDBOOKS. 2003.
3. Huh S. Clinics in Orthopedic Surgery's Evolution into an International Journal Based on Journal Metrics. *Clin Orthop Surg*. 2016 Jun;8(2):127-32. <https://doi.org/10.4055/cios.2016.8.2.127>
4. Demirhan M. From The Editor. *Acta Orthop Traumatol Turc*. 2008;42:149-53.
5. Yalçınkaya M, Bagatur AE. Articles published in *Acta Orthopaedica et Traumatologica Turcica* between 2003-2012: content, characteristics and publication trends. *Acta Orthop Traumatol Turc*. 2014;48(5):576-83. <https://doi.org/10.3944/AOTT.2014.14.0079>
6. JG Wright. Editorial. Introducing Levels of Evidence to The Journal: *JBJS - LWW Journals*, 2003
7. Reich MS, Shaw J, Barrett I, Goldberg VM, Schnaser E. Level of evidence trends in the *Journal of Bone and Joint Surgery*, 1980-2010. *Iowa Orthop J*. 2014;34:197-203.
8. Rehn C, Kronman U. Bibliometric handbook for Karolinska Institutet. [Cited 2013 Sep 8]. Available from: http://ki.se/content/1/c6/01/79/31/bibliometric_handbook_karolinska_institutet_v_1.05.pdf.
9. Sprague S, Matta JM, Bhandari M. Anterior Total Hip Arthroplasty Collaborative (ATHAC) Investigators, Dodgin D, Clark CR, Kregor P, Bradley G, Little L. Multicenter collaboration in observational research: improving generalizability and efficiency. *J Bone Joint Surg Am*. 2009 May;91(Suppl 3):80-6. <https://doi.org/10.2106/JBJS.H.01623>
10. Obremskey WT, Pappas N, Attallah-Wasif E, Tornetta P, 3rd, Bhandari M. Level of evidence in orthopaedic journals. *J Bone Joint Surg Am*. 2005;87(12):2632-8. <https://doi.org/10.2106/JBJS.E.00370>
11. Hurwitz SR, Slawson D, Shaughnessy A. Orthopaedic information mastery: applying evidence-based information tools to improve patient outcomes while saving orthopaedists' time. *J Bone Joint Surg Am*. 2000;82:888-94. <https://doi.org/10.2106/00004623-200006000-00020>
12. Scheschuk JP, Mostello AJ, Lombardi NJ, Maltenfort MG, Freedman KB, Tjoumakaris FP. Levels of Evidence in Orthopaedic Trauma Literature. *J Orthop Trauma*. 2016 Jul;30(7):362-6. <https://doi.org/10.1097/BOT.0000000000000557>
13. Holzer LA, Holzer G. Analysis of scientific articles published in two general orthopaedic journals. *Acta Orthop Bras*. 2013;21(5):281-4. <https://doi.org/10.1590/S1413-78522013000500008>